Do-Now (1/15):

- Please take out the chemical reaction worksheet from yesterday and complete the follow-up questions at the end

- Make sure you are using the part 1 reactions to answer the questions and not the part 2

Types of Chemical Reactions

Predicting Products from the Reactants

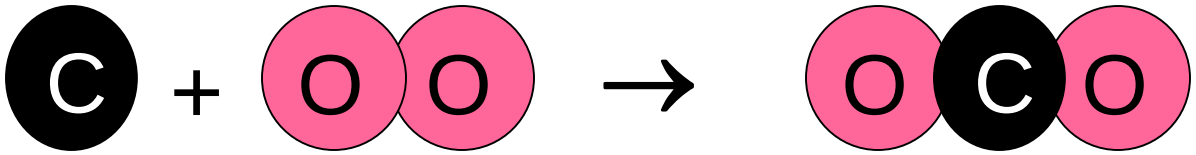
Types of Reactions

1. Synthesis reactions
2. Decomposition reactions
3. Double Replacement reactions
4. Single Replacement reactions
5. Combustion reactions

You need to be able to identify each

1. Synthesis

Example $C + O_2$

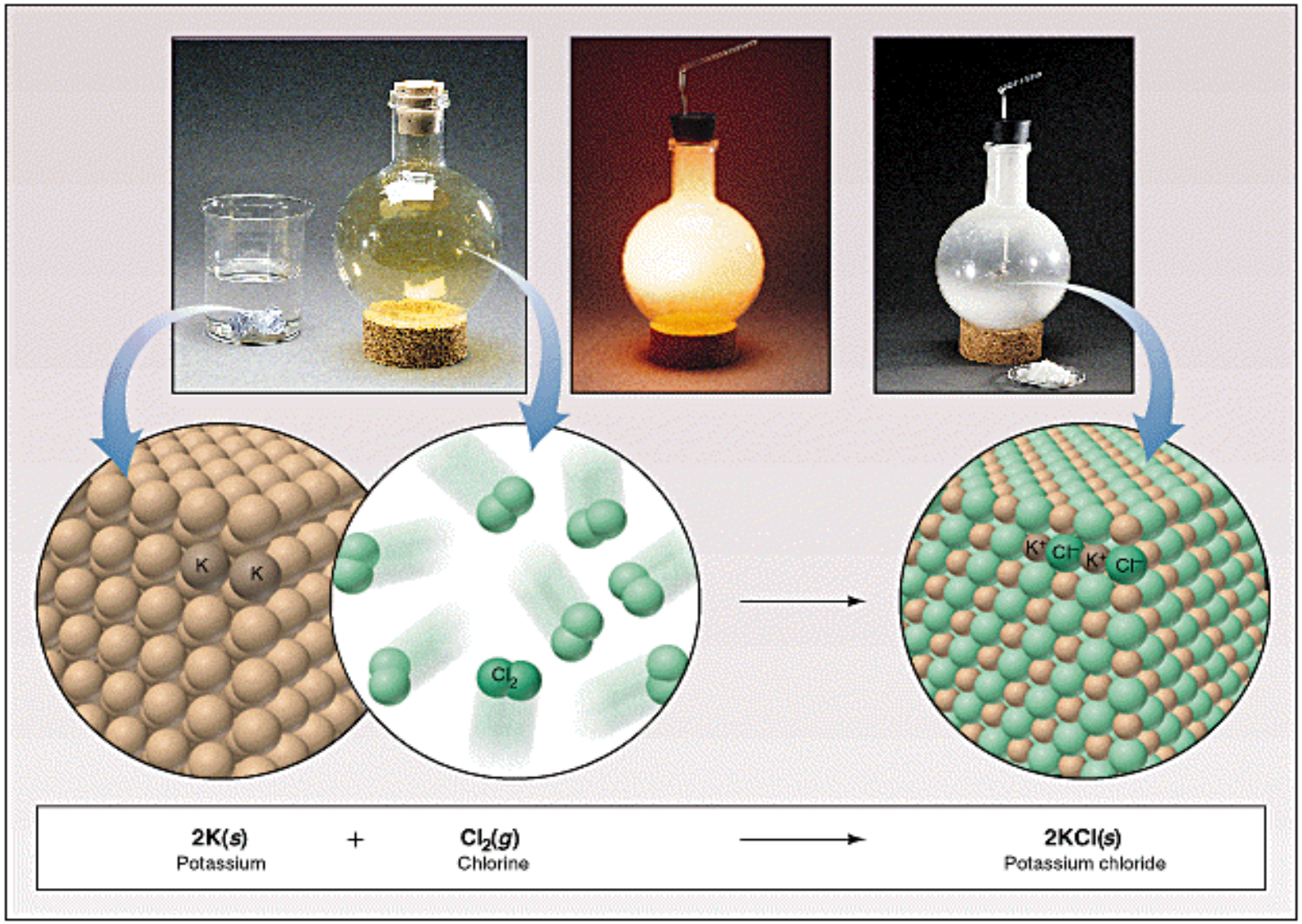


Synthesis: $A + B \rightarrow AB$

Definition

A **synthesis** reaction always involves two or more substances (usually elements) as reactants. The reactants combine to form only **one product.**

Ex. Synthesis Reaction



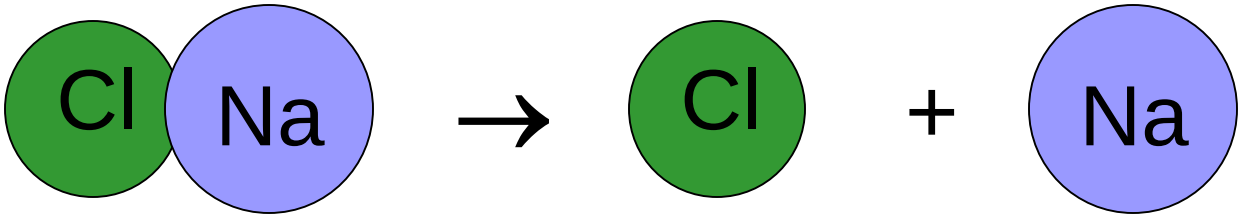
Practice

- Predict the product. Then, complete and balance the equation:

1. $Al + Cl_2 \rightarrow$
2. $Na + Br_2 \rightarrow$

2. Decomposition

Example: NaCl



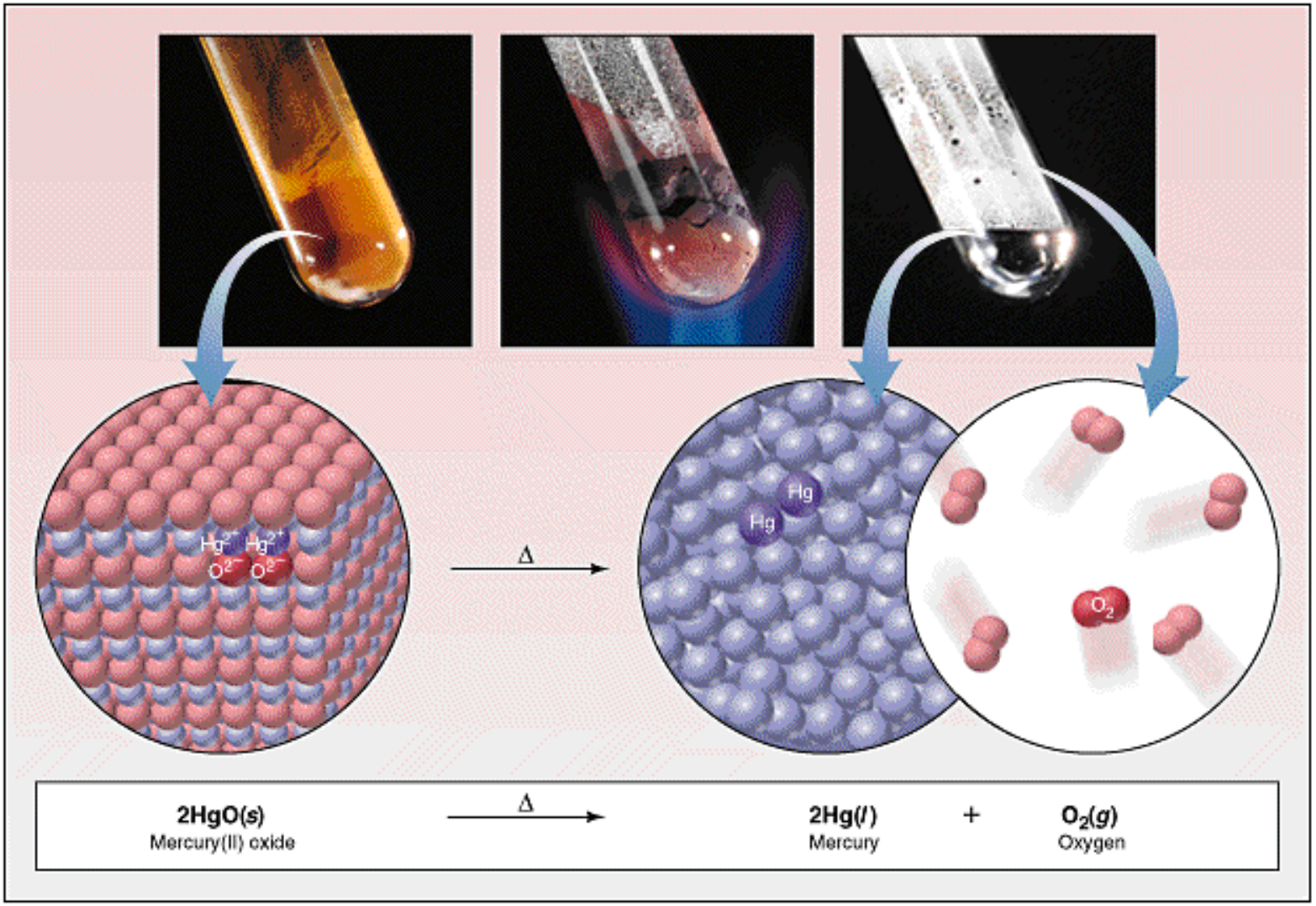
General: $AB \rightarrow A + B$

Compound = Element + Element

Definition

A **decomposition** reaction always involves a **single reactant** breaking down (decomposing) into two or more products.

Ex. Decomposition Reaction



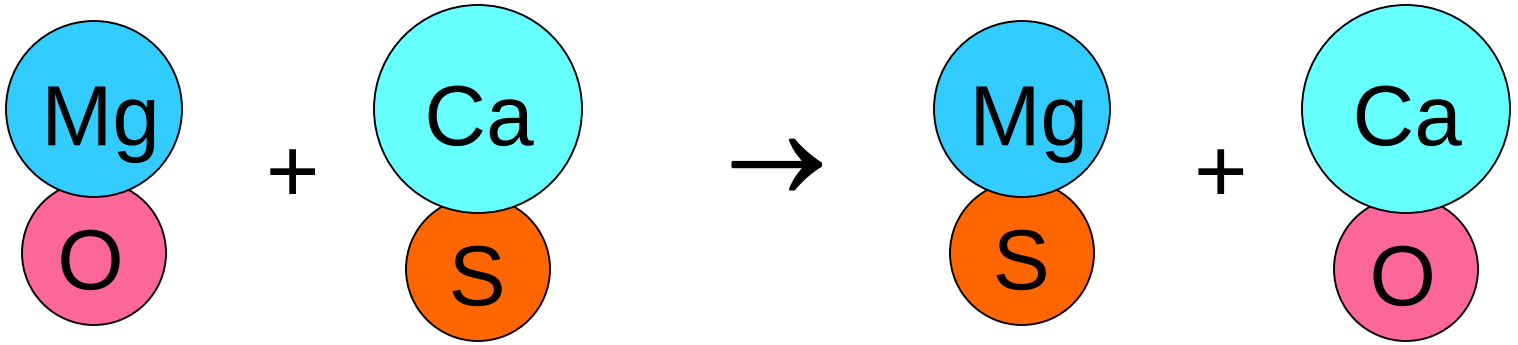
Practice

- Predict the product. Then, complete and balance the equation:

1. NBr_3 →
2. LiH →

3. Double Replacement

Example: MgO + CaS



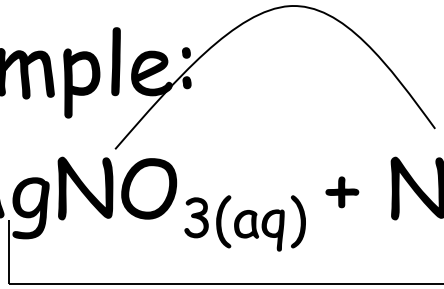
General: $AB + CD \rightarrow AD + CB$

Definition

A **double replacement** reaction usually involves two aqueous compounds. During the replacement, the ions of the solutions switch with each other.

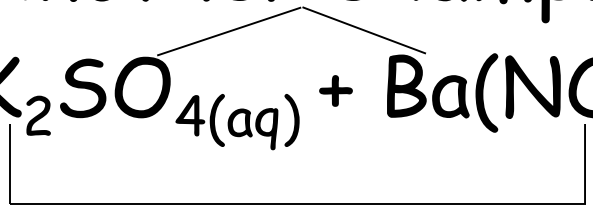
Double Replacement Reactions

- Think about it like "foil"ing in algebra, first and outer ions go together + inside ions go together
- Example:



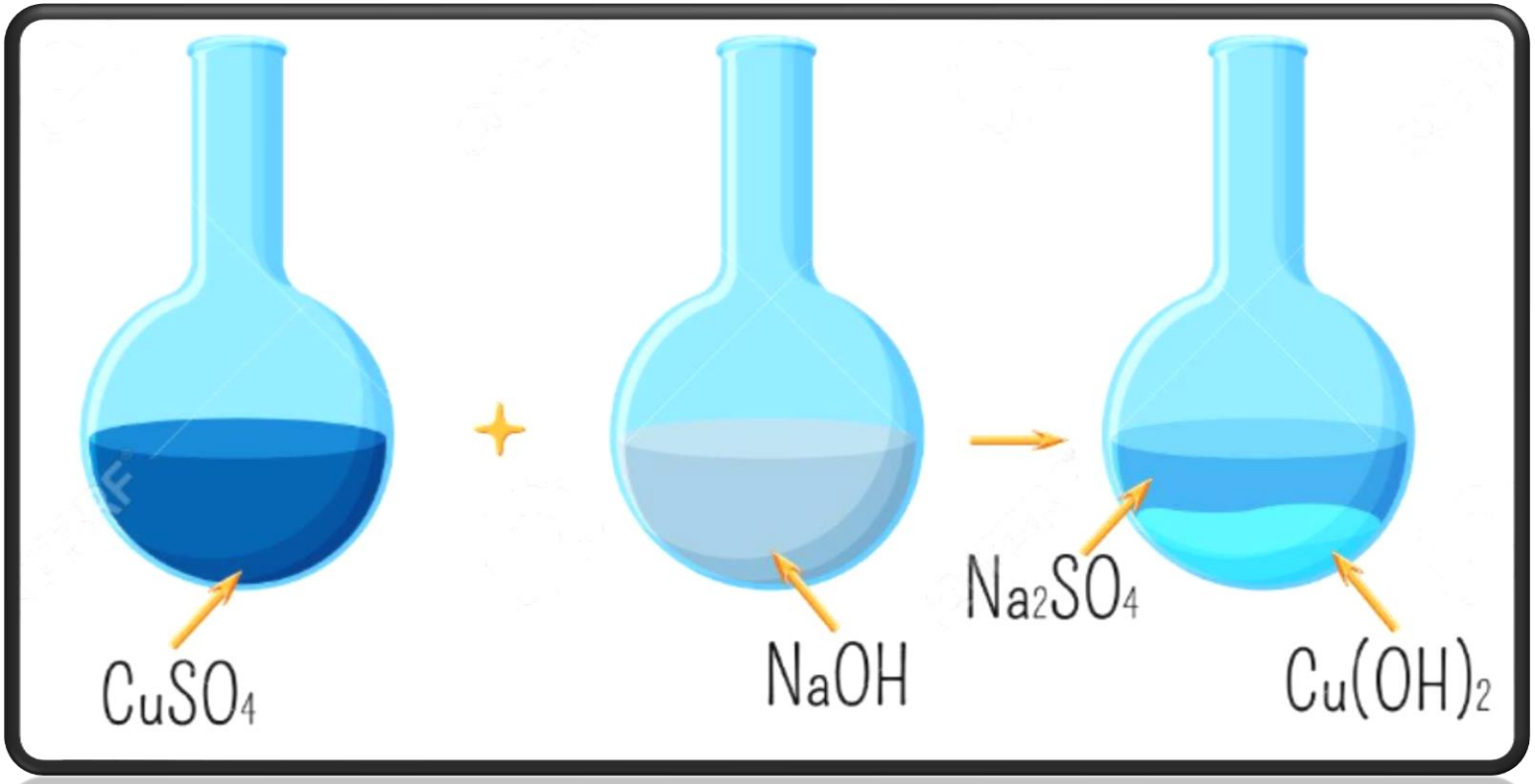
$$AgNO_{3(aq)} + NaCl_{(s)} \rightarrow AgCl_{(s)} + NaNO_{3(aq)}$$

- Another example:



$$K_2SO_{4(aq)} + Ba(NO_3)_{2(aq)} \rightarrow 2KNO_{3(aq)} + BaSO_{4(s)}$$

Ex. Double Replacement Reaction



Practice

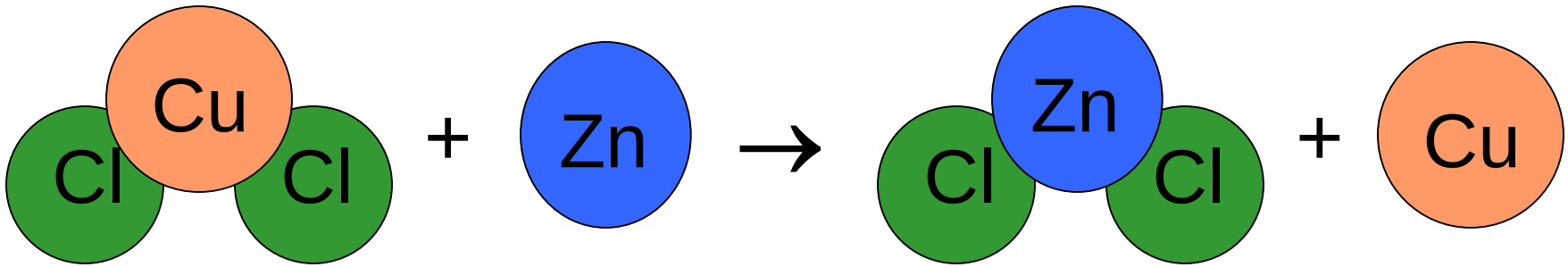
- Predict the products:

1. $CaCl_{2(aq)} + Na_3PO_{4(aq)} \rightarrow$

2. $Pb(NO_3)_{2(aq)} + BaCl_{2(aq)} \rightarrow$

4. Single Replacement

Example: $Zn + CuCl_2$



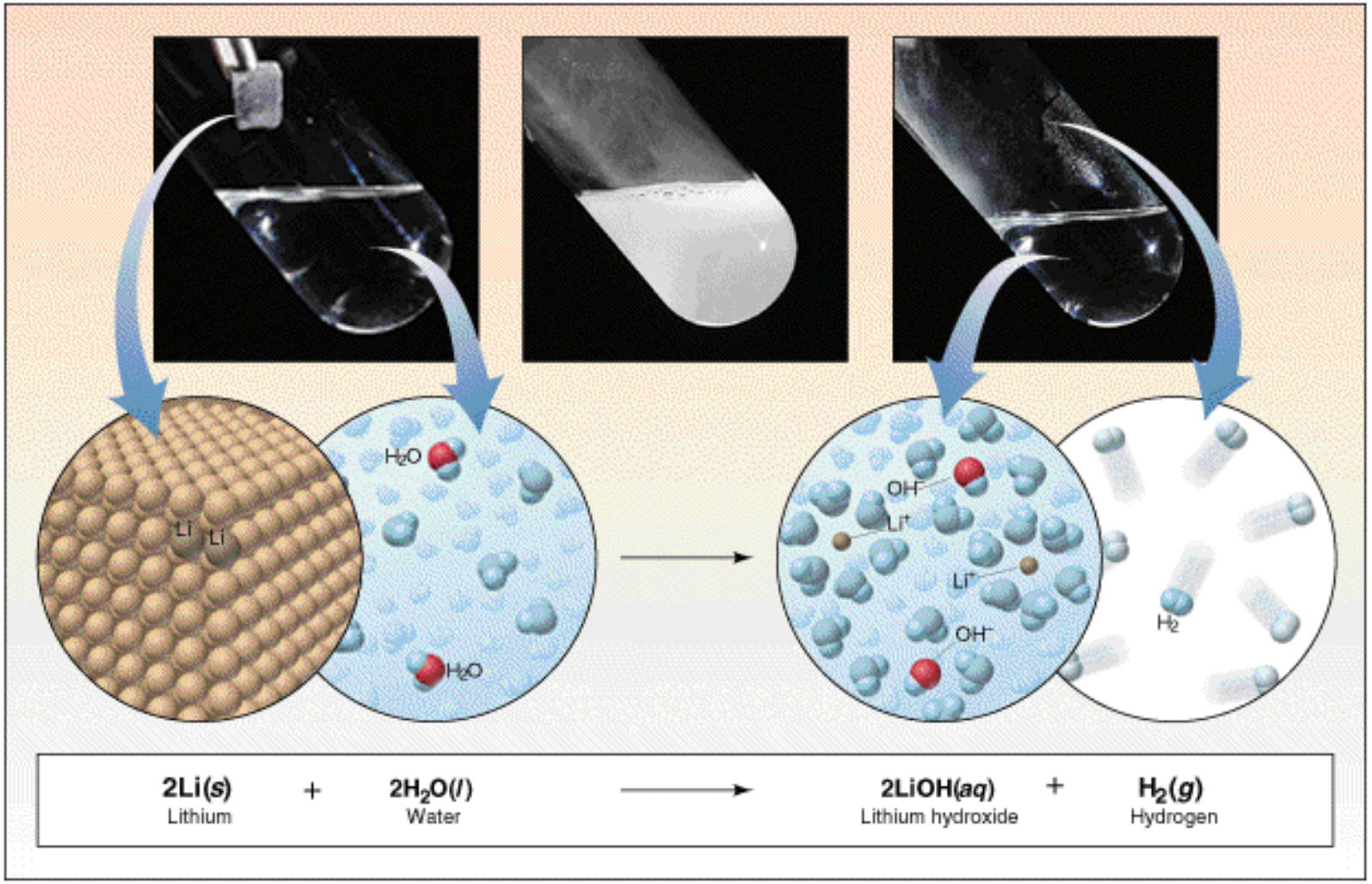
General: $AB + C \rightarrow AC + B$

Compound + Element = New Compound + New Element

Definition

A **single replacement** reaction involves **a compound and a free element** as the reactants. During the reaction, the free element replaces one of the elements in the compound to form a different compound and free element.

Ex. Single Replacement Reaction



Practice

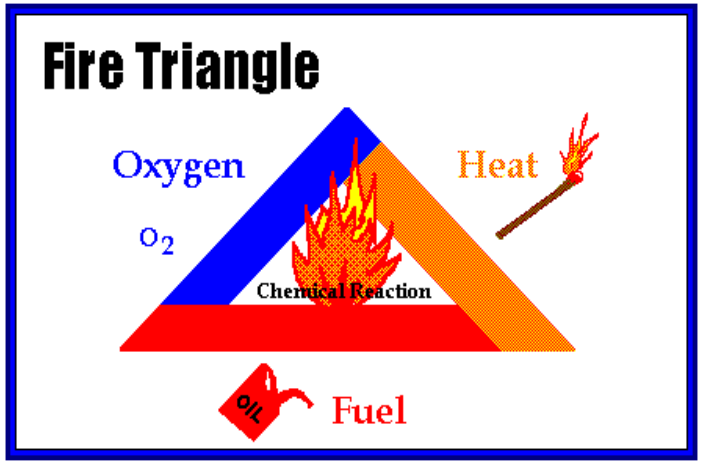
Write and balance the following single replacement reaction equations:

1. $Zn_{(s)} + HCl_{(aq)} \rightarrow$

2. $Al_{(s)} + Cu(NO_3)_{2(aq)} \rightarrow$

5. Combustion Reactions

- **Combustion reactions** – when a hydrocarbon reacts with oxygen gas
- This is also called **BURNING!**
- In order to burn something you need the 3 things in the "fire triangle":



- 1) Fuel (hydrocarbon)
  2) Oxygen
  3) Something to ignite the reaction (spark)

Combustion Reactions

- In general:
  $C_xH_y + O_2 \rightarrow CO_2 + H_2O$

- Products are **ALWAYS**
  CARBON DIOXIDE AND WATER!

- Combustion is used to heat homes and run automobiles (octane, as in gasoline, is a hydrocarbon: C_8H_{18})

Practice

- Predict the products. Then, complete the balanced chemical equation. :

1. $C_8H_{18} + O_2 \rightarrow$

Mixed Practice

- State the type of reaction & predict the products. Then, write out and balance the chemical reaction equation.

1. $SrI_2 + LiCN \rightarrow$
2. $Zn + Na_2SO_4 \rightarrow$
3. $Cs + Br_2 \rightarrow$

Mole Ratios

- Chemists use a balanced chemical equation to calculate how much reactant is needed or how much of a product is formed in a reaction.

- The ratio of the moles of each reactant and product in a reaction is known as the **mole ratio**.

- The mole ratio can be used to calculate the number of moles and mass of reactants and products.

Mole Ratios

- The mole ratio is the ratio of the coefficients for reactants and products found in the balanced chemical reaction.

- In the reaction: $2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$
  The ratio of Mg: O_2: MgO is 2:1:2

Mole Ratios

Given the Equation:

$2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$

How many moles of magnesium are needed to react with 3.7 moles of $O_{2(g)}$?

How many grams of Mg(s) is this?

Practice

For the following equation:

$CaO \rightarrow$

a. Predict the products, write out, and balance the chemical equation.
b. How many moles of oxygen will be produced if 8 moles of calcium oxide are used?
c. How many grams of oxygen will be produced?
d. Draw the Lewis Diagram of the reactant and the covalent product.